Title

Outcomes of a Clinic-Based Educational Intervention for Cardiovascular Disease Prevention by Race, Ethnicity, and Urban/Rural Status

Journal

Journal of Women's Health, 25(11)

ISSN

1540-9996

Authors

Villablanca, Amparo C
Slee, Christina
Lianov, Liana
et al.

Publication Date

2016-11-01

DOI

10.1089/jwh.2015.5387

Peer reviewed

JOURNAL OF WOMEN'S HEALTH
Volume 25, Number 11, 2016

DOI: 10.1089/jwh.2015.5387

Outcomes of a Clinic-Based Educational Intervention for Cardiovascular Disease Prevention by Race, Ethnicity, and Urban/Rural Status

Amparo C. Villablanca, MD,[1] Christina Slee, MPH,[2] Liana Lianov, MD,[3] and Daniel Tancredi, PhD[4]

Abstract

Background and Purpose: Heart disease is the leading killer of women and remains poorly recognized in high-risk groups. We assessed baseline knowledge gaps and efficacy of a survey-based educational intervention.
Methods: Four hundred seventy-two women in clinical settings completed pre-/post-surveys for knowledge of: heart disease as the leading killer, risk factors (general and personal levels), heart attack/stroke symptoms, and taking appropriate emergency action. They received a clinic-based educational intervention delivered by healthcare professionals in the course of their clinical care. Change score analyses tested pre-/post-differences in knowledge after the educational intervention, comparing proportions by race, ethnicity, and urban/nonurban status.
Results: Knowledge and awareness was low in all groups, especially for American Indian women ($p < 0.05$). Awareness was overall highest for heart disease as the leading killer, but it was the lowest for taking appropriate action (13% of Hispanic, 13% of American Indian, 29% of African American, and 18% of nonurban women; $p < 0.05$). For all women, knowledge of the major risk factors was low (58%) as was knowledge of their personal levels for risk factors (73% awareness for hypertension, 54% for cholesterol, and 50% for diabetes). The intervention was effective (% knowledge gain) in all groups of women, particularly for raising awareness of: (1) heart disease as the leading killer in American Indian (25%), Hispanic (18%), and nonurban (15%) women; (2) taking appropriate action for American Indian (80%), African American (64%), non-Hispanic (55%), and urban (56%) women; (3) heart disease risk factors for Hispanic (56%) and American Indian (47%) women; and (4) heart disease and stroke symptoms in American Indian women (54% and 25%, respectively).
Conclusions: Significant knowledge gaps persist for heart disease in high-risk women, suggesting that these gaps and groups should be targeted by educational programs. We specify areas of need, and we demonstrate efficacy of a clinic-based educational intervention that can be of utility to busy healthcare professionals.

Keywords: preventive cardiology, community, race, ethnicity, rurality

Introduction

Cardiovascular disease (CVD), a preventable and treatable disease, is the leading cause of death for women in the United States, comprising 22.4% of deaths in women of all ages in 2013.[1] Persistent disparities in healthcare for minority high-risk populations remain a national concern. In addition, physician awareness and adherence to cardiovascular disease prevention guidelines nationally have been shown to be suboptimal, in part due to lower perceived risk in women.[2]

A 2012 national survey conducted by the American Heart Association (AHA) found that although there has been an improving 15 year trend for awareness of heart disease as women's greatest health threat, it is still, nonetheless, cited by only 56% of women,[3] and women ''at risk'' or ''high risk'' for CVD, 48% and 21%, respectively, did not perceive themselves to be at any risk,[4] demonstrating a persistent disconnect between women's risk awareness and perception. About 46% of women become disabled due to heart failure within 6 years of having a heart attack.[5] These sobering

[1]Division of Cardiovascular Medicine, University of California, Davis, Davis, California.
[2]Clinical Affairs Division, University of California, Davis Medical Center, Davis, California.
[3]Department of Internal Medicine, American College of Lifestyle Medicine, University of California, Davis, Davis, California.
[4]Department of Pediatrics, Center for Healthcare Policy and Research, University of California, Davis, Davis, California.

statistics underscore the need for continued efforts at prevention, improved awareness, and educational campaigns.

Cardiovascular risk factors are prevalent in women; however, they are often unrecognized due to a lack of awareness and appropriate screening.[6,7] Two out of three women have at least one of the following major risk factors: high blood pressure, high cholesterol, diabetes mellitus, physical inactivity, or obesity.[8] In addition, prevalence of the metabolic syndrome (a clustering of cardiovascular risk factors) is higher after menopause.[2,9] Individual cardiovascular disease risk in women is further worsened by the fact that women often fail to make the connection between risk factors and their own likelihood of developing heart disease, falsely believing that they are immune. Women are also more likely to experience ''atypical'' symptoms such as nausea, indigestion, palpitations, dyspnea, and fatigue.[10,11] Furthermore, the prevalence of silent ischemia has been shown to be as high as 33% in women with coronary artery disease.[12] These factors add complexity to proper and timely recognition and evaluation of heart disease symptoms in women.

Effective prevention and detection of heart disease in women is further complicated by disparities across racial and ethnic backgrounds and urban status. Racio/ethnic minority women and women living in nonurban settings face specific health challenges that are directly related to risk factor knowledge, personal behavior, access to healthcare, and other factors.[13–15] In addition, ischemic heart disease in women aged 20 and older has been shown to be the highest in small rural counties.[16] Direct correlations exist between race/ethnicity and morbidity/mortality due to heart disease.[8,17] African American women have the highest age-adjusted heart disease death rate among any female race/ethnicity group in the United States. In 2013, the heart disease death rate was 245 per 100,000 for African American women compared with 183 per 100,000 for white women.[18] Furthermore, the prevalence of heart disease risk factors varies significantly with racial/ethnic background as well. For example, Hispanics have one of the highest rates of diabetes, and $\sim$12% of adult African Americans have diabetes with resulting vascular complications.[19] Thus, knowledge and awareness of heart disease risk is a key theme to help empower women to adopt healthy lifestyles, encourage prevention, and reduce disparities in heart disease.

The primary research questions of this study were as follows: (1) What is the knowledge and awareness of heart disease in women in a convenience sample from a variety of clinical healthcare settings in Northern California? (2) What are the specific gaps in knowledge and awareness across racial and ethnic backgrounds and urban status? (3) To what extent can an educational intervention delivered in the clinical setting be effective in improving knowledge and awareness? We hypothesized that clinical care settings can serve as effective portals to identify and bridge gaps in heart disease education in racial/ethnic minority women and women in nonurban settings.

Materials and Methods

Study population

We enrolled women who were attending a previously scheduled clinic appointment and who self-reported as Latina/Hispanic, Black/African American, American Indian, or Caucasian/Other (The Other category was used as a convenience category due to the very low numbers of Asians, Native Hawaiians, and other Pacific Islanders in the study sample, as more than 99% of the Other category was Caucasian.). Data on the highest educational level achieved by participants were provided by some of the sites. Participants completed surveys that were anonymous, and, thus, not linked to medical record information for prior cardiac diagnosis or past medical history. Women were enrolled from a total of five urban and nonurban clinic settings in Northern California (see next for a description of clinics). Study enrollment and the intervention took place over a period from 2008 to 2010. The University of California, Davis Medical Center Institutional Review Board approved the study, and all participants provided informed consent prior to participating in the study. There were no exclusion criteria for the educational intervention other than that women had to be adults and to be able to comprehend and respond to the study questions.

Clinical study sites

The five clinical sites in Northern California were as follows:

The UC Davis Women's Cardiovascular Medicine Program (WCVMP) Clinic, Sacramento, California: Established in 1994, the UC Davis WCVMP is an urban site that resides in the University of California, Medical Center in Sacramento, CA, and, as such, serves a tertiary care population. The clinic is in the Division of Cardiovascular Medicine and is co-localized in hospital outpatient facilities with the Cardiac Rehabilitation Program. It provides specialty cardiovascular services to women seeking primary or secondary prevention. Several healthcare professionals from each of these programs participated in delivery of the educational intervention at this site, consisting primarily of RNs and clinical research personnel.

UC Davis Primary Care Clinic in Colusa, California: Located in the county of Colusa, $\sim$60 miles north of Sacramento in Northern California, the UC Davis Colusa Primary Care Clinic is a small nonurban outlying clinic that is owned and operated by the UC Davis Health System. Adjacent to the clinic is a 42-bed not-for-profit community hospital. With 17% of this community's 5,400 residents below the federal poverty level, this clinic serves a large number of ethnic minority individuals who are underinsured. The clinic resides in a Health Professionals Shortage Area and provides general, primary care and primary prevention services. Two healthcare providers participated in delivery of the educational intervention at this site (LVN and RN).

Alliance Medical Center in Healdsburg, California: This center in Sonoma County Alliance Medical Center treats a high percentage of Latina women, many of whom have diabetes. Eighty percent of patients presenting to this clinic are Hispanics. Serving a nonurban community with more than 10,000 residents in its immediate area, as well as several outlying communities, this primary care clinic offers general and primary prevention services and is located in a medically underserved area that is designated for low-income populations. Approximately 59% of the clinic's patient volume is either at or below the poverty level. A small hospital is located on the same property next to the clinic. Two

healthcare providers worked and delivered the educational intervention at this clinic site (LVN and RN).

UC Davis Primary Care Network in Elk Grove, California: The UC Davis Primary Care Clinic in Elk Grove is located ~13 miles south of the downtown Sacramento area and serves an urban community. The clinic offers general and primary prevention services and has a high percentage of African American women patients. Two healthcare providers delivered the educational intervention at this site (RN and MD).

Round Valley Indian Health Service Clinic in Mendocino County, California: This primary care clinic offers general and primary prevention services, is located in the remote Northwest coast of California, and serves a nonurban community of American Indian women. Approximately 25% of the patients are either at or below the poverty level. A large number of patients presenting to this clinic are either uninsured or underinsured. Two healthcare providers participated in delivery of the educational intervention at this site (LVN and MD).

Survey and educational intervention

All participants completed a two-page standardized self-administered Knowledge Awareness and Risk Assessment Survey instrument in the course of a previously scheduled medical visit. Surveys were administered during a single clinic visit, and the same survey was administered both before (pre) and approximately an hour after (post) the educational intervention. The survey questions are summarized in Table 1 and were provided to the study sites by the UC Davis Women's Cardiovascular Medicine Program to maintain uniformity for all sites. The instrument was available to women in English or Spanish, and it was adapted from one validated by the U.S. Department of Health and Human Services Office of Women's Health[6,20] and linked with the assessment of specific Healthy People 2020 heart disease outcomes (Heart Disease and Stroke objectives): http://www.healthypeople.gov/2020/topics-objectives/topic/heart-disease-and-stroke/objectives

Women were individually educated on the survey questions by a health professional at each of the five clinical sites

Table 1. Survey Questions

1. Heart disease in women
   True or false:
   a. Heart disease is the leading killer of women.
   b. Heart disease is preventable.
2. Which of the following are risk factors for heart disease? (Check all that apply in general, not just to you.)
   a. High blood pressure
   b. Lack of physical exercise and activity
   c. High cholesterol
   d. Smoking
   e. Menopause
   f. Diabetes
   g. Seizures
   h. Depression
   i. Being obese or overweight
   j. Heart disease in your family

(*continued*)

Table 1. (Continued)

3. Do you know your numbers?
   Please indicate the following:
   a. What is your blood pressure?
   b. What is your cholesterol?
   c. What is your blood sugar?
   d. What is your current weight?
   e. How often should you exercise (walk, run, jog, bike, swim, hike, lift weights, *etc.*)?
      i. Every day
      ii. 5–6 days/week
      iii. 3–4 days/week
      iv. 1–2 days/week
      v. Never
   f. For how long should you exercise?
      i. ≥30 minutes/day
      ii. 29–20 minutes/day
      iii. 19–10 minutes/day
      iv. <10 minutes/day
4. Which of the following are symptoms of a heart attack? (Check all that apply.)
   a. Pain, heaviness, fullness, or tightness in the chest lasting more than a few minutes
   b. Shortness of breath
   c. Tingling in the leg
   d. Chest discomfort with sweatiness, especially with exertion
   e. Chest discomfort with fatigue or weakness, especially with exertion
   f. Cough and sore throat
   g. Pain or discomfort spreading to the jaw, shoulder, neck, or arm
   h. Chest discomfort with nausea, especially with exertion
   i. Chest discomfort with fainting
   j. A feeling of impending doom
5. Which of the following are symptoms for stroke? (Check all that apply.)
   a. Sudden weakness or numbness of the face, arm, or leg on one side of the body
   b. Sudden dimness or loss of vision, particularly in one eye
   c. Loss of speech, or trouble talking or understanding speech
   d. Sudden abdominal pain and diarrhea
   e. Sudden, severe headaches with no apparent cause
   f. Unexplained dizziness, unsteadiness, or sudden falls, especially along with any of the other symptoms listed earlier
6. If you experience any of the symptoms and warning signs of stroke or heart attack, and they persist for longer than 5 minutes, you should:
   a. Drive yourself to the nearest hospital
   b. Ask a friend or relative to drive you to the nearest hospital
   c. Call your doctor the next day
   d. Call 911
   e. Try to ignore the symptoms, as they will likely go away on their own
7. Have you received prior counseling from a health professional about risk factors for heart disease (for diabetes, smoking cessation, physical activity, and a heart-healthy diet)?
   a. Yes
   b. No

(described next) by a site MD, RN, LVN, and/or clinical coordinator (based on their availability and site discretion). Education was based on a brief discussion (~ 10–15 minutes) of the correct replies to each of the survey questions. The information was delivered in Spanish or English by healthcare professionals at each of the clinical sites. Translators were not used. If incorrect responses were provided, a brief explanation was given to the participant as to why the participant's reply was incorrect, and the correct answer was provided. The correct replies were provided to each study site by the UC Davis Women's Cardiovascular Medicine Program to ensure uniformity of the information provided to women.

Outcomes measures

Self-reported awareness and knowledge of seven outcomes were collected by the surveys (correct answer) for: (1) heart disease as the leading killer of women; (2) general knowledge of heart disease risk factors; (3) knowledge of their own personal risk factors (whether they knew their numbers for blood sugar, blood pressure, and cholesterol); (4) their knowledge about engagement in physical activity (frequency and duration); (5) the major warning signs and symptoms of a heart attack and stroke; (6) taking emergency action by calling 911; and (7) prior health behavior counseling for diabetes, smoking cessation, physical activity, and a heart-healthy diet.

Statistical analysis

Primary analyses used frequency tables to examine project outcomes and targets by comparing the proportions in the study groups (namely nonurban versus urban, and several racial/ethnic groups) and pre- and post-test mean change in risk awareness and knowledge by race/ethnicity and nonurban status.

For the knowledge change score analysis, we used a score difference measure to assess changes in knowledge in the women surveyed. Knowledge outcomes were presented in a series of tables reporting the relative frequency (as a percentage) of each combination of pretest and post-test correct/incorrect response, with mean gains in knowledge indicated along with confidence intervals. Responses from each participant for each knowledge item at each timepoint were assigned a binary score of 1 if correct and 0 if incorrect. For each knowledge item, a within-person gain score was computed to allow the assessment of changes in knowledge due to the curriculum and to compare learner groups with respect to these knowledge changes. The gain score was scored a −1 for a decline in knowledge, 0 for no change in knowledge, and 1 for a gain in knowledge. The gain score was scored a −1 for a decline in knowledge (*i.e.,* correct at pretest, incorrect at post-test), 0 for no change in knowledge (*i.e.,* incorrect at both timepoints or correct at both timepoints), and 1 for a gain in knowledge (*i.e.,* incorrect at pretest, correct at post-test). The mean gain score is mathematically equivalent to the proportion of learners who gained knowledge minus the proportion who lost knowledge. Mean gain scores were multiplied by 100 so that these differences in proportions are expressed as differences in percentages, for simplicity in interpretation. Confidence intervals for mean differences and statistical significance testing for between-group comparisons of differences were based on the assumption that the sampling distribution for mean gain scores can be approximated by a T-distribution, given our moderately large sample size, and were computed using analysis of variance procedures for unbalanced groups in SAS/Stat software (*i.e.,* PROC GLM). The 95% confidence interval for the within-group mean differences can be used to assess whether differences are statistically significant from 0 ($p < 0.05$) by assessing whether 0 is excluded from the confidence interval, analogously to inferences from a paired *t*-test for comparing pre- and post-test knowledge scores. Significance testing results are also closely related to inferences from a McNemar test for paired binary data but with the advantage of including a confidence interval for the effect size estimate.[21] For between-group pair-wise comparisons involving the three-level RACE factor, the Scheffe procedure was used to control the overall type-1 error rate for these three pair-wise comparisons as well as for estimating confidence intervals for mean gain scores. Analyses were carried out with SAS version 9.2 (SAS Institute, Cary, NC).

Results

A sample of 472 women was studied (Table 2). The composition of the study group was as follows: (1) Ethnicity: 11.4% Hispanic; (2) Race: 28.6% Black/African American, 4.4% American Indian, and 55.5% Caucasian/Other (9.1% of women declined to state their ethnicity/race and were excluded from the analysis); and (3) Urban/Nonurban: 21.2% were in nonurban settings. The mean age of participants was 54.3 years.

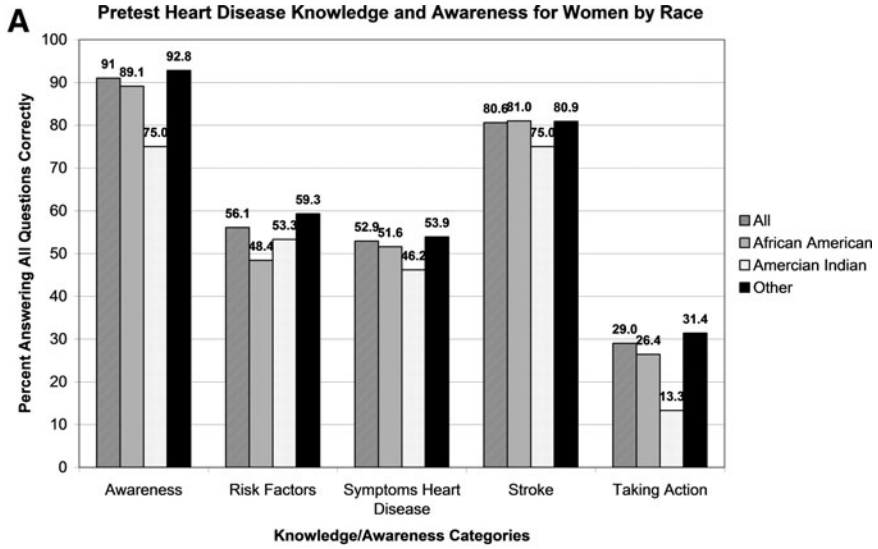
Pretest baseline knowledge and awareness differed by race, ethnicity, and urban status

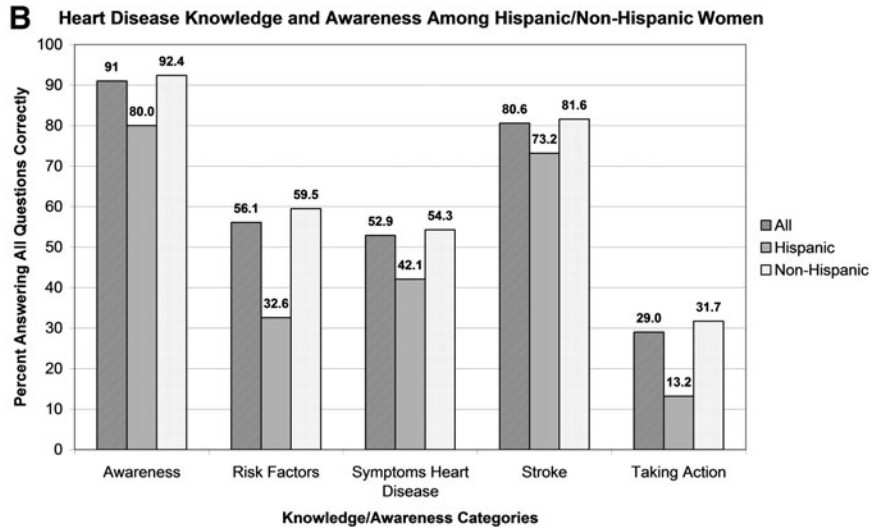
Analysis of pre (baseline) knowledge and awareness of heart disease as the leading killer, the major risk factors, symptoms for heart disease and for stroke, and of taking appropriate action for symptoms revealed significant differences

Table 2. Respondent Demographics ($N = 472$)

Ethnicity (%)	
Hispanic or Latina	54 (11.4)
Non-Hispanic or Latina	418 (88.6)
Race (%)	
Caucasian/Other[a]	262 (55.5)
Black/African American	135 (28.6)
American Indian	21 (4.4)
Not specified by respondent	43 (9.1)
Nonurban (%)	100 (21.2)
Urban (%)	372 (78.8)
Education, %, $n = 189$	
Some high school or less	4.2
High school graduate	15.3
Some college, vocational, or technical school	33.3
College graduate	20.1
Postgraduate	14.8
Unknown/missing	12.2
Age (range)	Mean 54.3 years (21–86)

[a]Other: Asian, Native Hawaiian, or Other Pacific Islander.





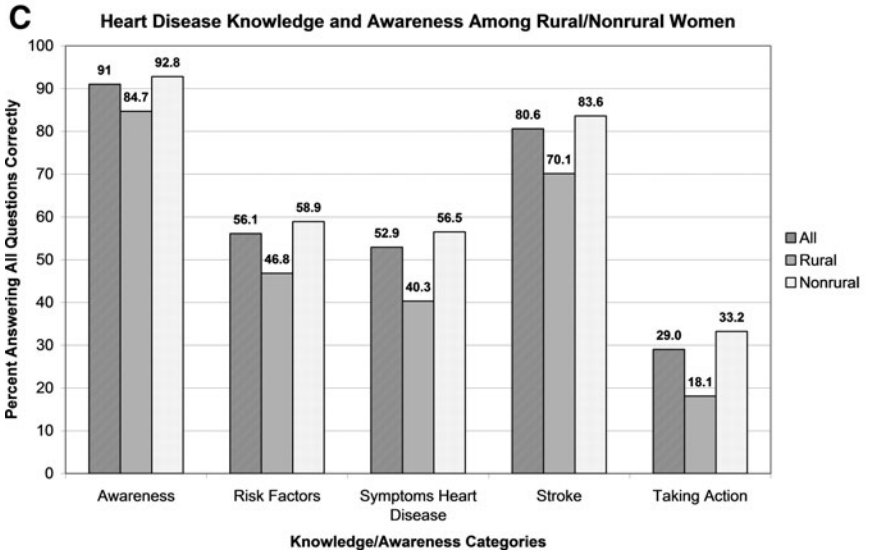


FIG. 1. Women's pretest knowledge and awareness of heart disease by race **(A)**, ethnicity **(B),** and urban status **(C)**. Based on self-administered surveys. See text for statistically significant differences.

across racial minority, ethnic minority, and nonurban groups of women.

Figure 1A summarizes the baseline knowledge and awareness data by race. Compared with the other racial groups studied, American Indian women had significant deficits in awareness, as only 75% were able to answer all awareness questions correctly (vs. 89.1% and 92.8% of the African American and Caucasian/Other racial groups, respectively, $p < 0.05$). American Indian women also showed a greater deficit in knowledge for taking action for symptoms, as only 13.3% were able to answer all taking action questions correctly (compared with 26.4% and 31.4% for African American and Caucasian/Other groups, respectively).

The baseline knowledge and awareness data for ethnicity are summarized in Figure 1B. Compared with non-Hispanic women, Hispanic women demonstrated less awareness of heart disease as the leading killer of women, risk factors for heart disease, symptoms of heart attack and stroke, and taking the correct actions for symptoms. Specifically, significantly fewer Hispanic women answered 100% of the awareness questions correctly compared with non-Hispanic women (80% vs. 92.4%, $p < 0.05$), knew that heart disease is the leading killer of women (87.2% Hispanic vs. 96.5% non-Hispanic, $p < 0.01$), or knew all of the heart disease risk factors (32.6% of Hispanic vs. 59.5% non-Hispanic, $p < 0.001$), especially that diabetes is a heart disease risk factor. Similarly, compared with non-Hispanic women, significantly fewer Hispanic women were able to correctly answer 100% of the taking action questions (13.2% vs. 31.7%, $p < 0.05$). Hispanic women were less aware than non-Hispanic women of the importance of not driving oneself to the nearest hospital (76.7% Hispanic vs. 88.1% non-Hispanic, $p < 0.05$), or of asking a friend or relative to drive one to the nearest hospital (13.6% Hispanic vs. 31.9% non-Hispanic, $p < 0.05$).

The baseline knowledge and awareness data for urban status are summarized in Figure 1C. Compared with urban women, a significantly smaller percentage of nonurban women correctly answered 100% of questions in the following domains: awareness (84.7% of nonurban vs. 92.8% of urban women, $p < 0.05$), heart disease symptoms (40.3% of nonurban vs. 56.5% of urban women, $p < 0.05$), stroke symptoms (70.1% of nonurban vs. 83.6% of urban women, $p < 0.01$), and taking action (18.1% of nonurban vs. 33.2% of urban women, $p < 0.05$). Compared with urban women, nonurban women also had less awareness that heart disease is the leading killer of women (89.3% of nonurban vs. 97.2% of urban women, $p < 0.01$).

Knowledge of personal risk factor levels and prior counseling for risk factors differed by ethnicity and urban status, but not by race

We assessed women's pretest knowledge of their own personal levels for three major heart disease risk factors (blood pressure, cholesterol, and blood glucose). Table 3 summarizes these data for race, ethnicity, and urban status. There were no statistically significant racial differences in personal knowledge of values for blood pressure, cholesterol, or blood glucose levels. We also assessed participants' reports of having received prior counseling for heart-healthy behaviors and risk factors and found no difference by race (data not shown). In contrast, significantly lower percentages of Hispanic women, compared with non-Hispanic and all women in the study sample, knew their values for blood pressure, cholesterol, or blood sugar. In addition, compared with non-Hispanic women, a significantly smaller percentage of the Hispanic women knew their values for blood pressure (47.9% vs. 76.2%, $p < 0.01$), cholesterol (29.2% vs. 56.6%, $p < 0.01$), or blood sugar (33.3% vs. 51.6%, $p < 0.01$). There were no differences between Hispanic and non-Hispanic women for reported prior counseling for diabetes, a heart-healthy diet, and physical activity, and both groups reported overall low counseling rates (data not shown). Compared with urban women, nonurban women reported less knowledge of their personal values for blood pressure (58% vs. 77.4%, $p < 0.01$) and cholesterol (40% vs. 57.5%, $p < 0.01$). The percentage of nonurban women reporting prior health behavior counseling for cholesterol and physical activity did not differ from urban women, except that significantly fewer nonurban women reported diabetes counseling compared with urban women (14.3% vs. 42.4%, $p < 0.01$), data not shown.

Table 3. Pretest Knowledge of Levels of Major Heart Disease Risk Factors by Race, Ethnicity, and Urban Status

	Blood pressure	*Cholesterol*	*Blood sugar*
	Percentage of women		
Race			
All women	73.3	53.8	49.8
African American	75.4	48.5	47.0
American Indian	63.2	36.8	52.8
Other	73.0	57.1	50.8
Ethnicity			
All women	73.3	53.8	49.8
Hispanic	47.9[a]	29.2[a]	33.3[a]
Non-Hispanic	76.2	56.6	51.6
Urban status			
All women	73.3	53.8	49.8
Nonurban	58.0[b]	40.0[b]	40.0
Urban	77.4	57.5	52.4

No statistically significant racial differences for knowledge of values for blood pressure, cholesterol, and blood sugar.

[a]Statistically significant differences ($p < 0.01$) for knowledge of values for blood pressure, cholesterol, and blood sugar for Hispanics compared with non-Hispanics and all women.

[b]Statistically significant ($p < 0.01$) differences for knowledge of values for blood pressure and cholesterol for nonurban versus urban women. p-value for blood sugar knowledge = 0.06.

Racial minority women demonstrated low knowledge and awareness of heart disease, which was improved by the educational intervention

The pre–post change score analysis for race (Table 4) revealed that compared with other racial groups, American Indian women not only had the greatest baseline deficit in awareness but also achieved the greatest gains in knowledge and awareness after the educational intervention (defined by the ability to answer 100% of the questions in a category correctly). On average, the mean awareness gain for American Indian women was 25% (compared with 6.4% for

Table 4. Knowledge Change Score Analysis for Women by Race

Total n = *472*	*African American* (n = *132*)								*American Indian* (n = *19*)								*Caucasian/Other* (n = *305*)								
	Loss (−1)	*No change (0)*		*Gain (+1)*			*95% CI*		*Loss (−1)*	*No change (0)*		*Gain (+1)*			*95% CI*		*Loss (−1)*	*No change (0)*		*Gain (+1)*			*95% CI*		
Knowledge domain	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean gain × 100*	*LB*	*UB*	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean gain × 100*	*LB*	*UB*	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean gain × 100*	*LB*	*UB*	p
Awareness																									
Leading killer	0.0	0.0	97.6	2.4	127	2.4	−2.8	7.5	0.0	0.0	82.4	17.7	17	17.7	3.6	31.7	0.0	0.0	95.3	4.7	300	4.7	1.3	8.0	**0.02**
Heart disease preventable	1.8	2.7	89.3	6.3	112	4.5	−1.6	10.5	0.0	0.0	94.4	5.6	18	5.6	−9.6	20.7	2.2	0.4	95.5	1.9	269	−0.3	−4.3	3.5	0.12
100% on awareness questions	1.8	2.7	87.3	8.2	110	**6.4**	−1.8	14.5	0.0	0.0	75.0	25.0	16	**25.0**	3.6	46.4	1.9	0.4	90.9	6.8	263	**4.9**	−0.3	10.2	**0.04**
Taking Action																									
Call 911	0.8	0.0	95.1	4.1	123	3.3	−1.7	8.2	0.0	0.0	18.0	0.0	18	0.0	−13.0	13.0	0.7	0.4	95.9	3.0	270	2.3	−1.1	5.6	0.77
Call doctor that day	2.6	1.3	88.3	7.8	77	5.2	−4.4	14.7	6.7	0.0	80.0	13.3	15	6.6	−15.0	28.4	1.1	2.8	89.6	6.6	182	5.5	−0.7	11.7	0.98
Drive self to hospital	0.0	1.3	84.8	13.9	79	13.9	2.5	25.4	0.0	0.0	86.7	13.3	15	13.3	−12.9	39.6	2.1	0.5	85.0	12.4	193	10.3	3.0	17.7	0.75
Have friend drive to hospital	0.0	8.2	28.2	63.5	85	63.5	47.2	79.8	0.0	0.0	13.3	86.7	15	86.7	47.8	126.0	3.4	19.1	27.5	50.0	204	46.6	36.0	57.1	**0.003**
Ignore symptoms	1.3	0.0	98.7	0.0	78	−1.3	−7.0	4.4	0.0	0.0	93.3	6.7	15	6.7	−6.3	19.6	3.2	0.0	96.2	0.5	186	−2.7	−6.4	1.0	0.14
100% on take action	0.0	9.7	26.4	63.9	72	**63.9**	46.8	80.9	0.0	6.7	13.3	80.0	15	**80.0**	42.6	117.0	1.7	20.6	29.7	48.0	175	**46.3**	35.3	57.2	**0.006**
Heart Disease Risk Factors																									
High blood pressure	2.3	0.8	95.5	1.5	132	−0.8	−5.0	3.5	0.0	0.0	19.0	0.0	19	0.0	−11.2	11.2	0.3	1.3	95.8	2.6	306	2.3	−0.5	5.1	0.23
No exercise	0.8	0.8	96.1	2.3	128	1.5	−2.3	5.4	0.0	0.0	94.1	5.9	17	5.9	−4.7	16.4	0.0	0.3	97.7	2.0	307	2.0	−0.5	4.4	0.56
High cholesterol	1.5	0.8	96.2	1.5	132	0.0	−3.8	3.8	0.0	0.0	100.0	0.0	19	0.0	−10.0	10.0	0.3	1.3	96.4	2.0	305	1.7	−0.9	4.1	0.57
Smoking	1.5	1.5	93.1	3.8	131	2.3	−3.9	8.5	0.0	0.0	94.7	5.3	19	5.3	−11.1	21.6	0.0	1.0	91.5	7.5	305	7.5	3.5	11.6	0.14
Menopause	0.0	5.4	57.7	36.9	111	36.9	24.7	49.2	0.0	0.0	60.0	40.0	15	40.0	6.6	73.4	0.4	2.3	71.1	26.2	263	25.8	17.9	33.8	0.07
Diabetes	1.6	2.4	84.3	11.8	127	10.2	1.6	18.9	0.0	0.0	79.0	21.1	19	21.1	−1.4	43.5	1.7	2.0	85.5	10.8	297	9.1	3.4	14.8	0.35
Depression	1.9	4.6	64.8	28.7	108	26.8	14.9	38.8	0.0	0.0	68.8	31.3	16	31.3	0.3	62.2	1.1	2.2	76.6	20.2	273	19.1	11.5	26.5	0.20
Obesity	1.5	0.0	97.0	1.5	132	0.0	−4.6	4.6	0.0	0.0	94.7	5.3	19	5.3	−7.0	17.5	0.0	0.0	96.1	3.9	307	3.9	0.9	7.0	0.12
Family history	2.3	2.3	88.5	6.9	130	4.6	−2.1	11.3	0.0	0.0	79.0	21.1	19	21.1	3.5	38.6	0.3	1.6	91.9	6.2	308	5.9	1.5	10.2	**0.05**
100% on HD risk factors	2.2	11.8	46.2	39.8	93	**37.6**	22.9	52.4	0.0	0.0	53.3	46.7	15	**46.7**	9.9	83.5	1.3	6.4	58.1	34.3	236	**33.0**	23.8	42.3	0.50
Heart Disease Symptoms																									
Chest pain	0.0	0.8	93.7	5.6	126	5.6	−0.2	11.3	0.0	0.0	88.9	11.1	18	11.1	−4.1	26.4	0.0	0.7	94.0	5.3	284	5.3	1.4	9.1	0.58
Shortness of breath	0.8	1.6	92.9	4.8	126	4.0	−2.3	10.3	0.0	0.0	88.9	11.1	18	11.1	−5.5	27.8	0.4	1.1	92.1	6.5	278	6.1	1.9	10.4	0.47
Sweatiness	0.0	1.7	90.1	8.3	121	8.3	1.3	15.2	0.0	0.0	88.2	11.8	17	11.8	−6.8	30.3	0.0	1.5	90.8	7.7	273	7.7	3.1	12.3	0.83
Fatigue	0.8	1.7	80.8	16.7	120	15.9	7.2	24.5	0.0	0.0	88.2	11.8	17	11.8	−11.2	34.7	1.5	1.1	88.7	8.7	266	7.2	1.3	12.9	0.06
Pain spreading to jaw	0.0	1.7	83.2	15.1	119	15.1	6.6	23.7	0.0	0.0	76.5	23.5	17	23.5	0.9	46.2	1.5	1.8	87.9	8.8	272	7.3	1.7	13.0	**0.03**
Nausea	0.9	2.6	82.6	13.9	115	13.0	3.9	22.2	0.0	0.0	73.3	26.7	15	26.7	1.4	51.9	0.4	1.9	85.6	12.1	264	11.7	5.7	17.8	0.27
Fainting	0.0	1.7	86.3	12.0	117	12.0	3.6	20.4	0.0	0.0	83.3	16.7	18	16.7	−4.7	38.1	0.8	1.5	87.6	10.2	265	9.4	3.9	15.0	0.55
Feeling of doom	0.9	2.8	62.6	33.6	107	32.7	19.4	46.0	0.0	0.0	64.3	35.7	14	35.7	−1.1	72.6	0.8	2.1	62.7	34.4	244	33.6	24.8	42.4	0.97
100% on HD symptoms	2.1	4.2	49.5	44.2	95	**42.1**	26.5	57.6	0.0	0.0	46.2	53.9	13	**53.9**	11.8	95.9	2.7	5.0	51.1	41.1	219	**38.4**	28.1	48.6	0.55
Stroke Symptoms																									
Sudden weakness	0.0	1.6	91.9	6.5	124	6.5	1.1	11.8	0.0	0.0	94.1	5.9	17	5.9	−8.6	20.3	0.0	0.7	95.4	3.9	283	3.9	0.3	7.4	0.52
Sudden dimness	0.0	1.7	86.0	12.4	121	12.4	4.9	19.9	0.0	0.0	88.2	11.8	17	11.8	−8.2	31.7	0.7	1.5	90.8	7.0	272	6.3	1.3	11.2	0.14
Loss of speech	0.0	1.7	90.0	8.3	120	8.3	1.9	14.8	0.0	0.0	94.1	5.9	17	5.9	−11.3	23.0	0.4	1.1	92.9	5.7	280	5.3	1.1	9.6	0.56
Dizziness	0.0	1.8	88.3	9.9	111	9.9	2.9	17.0	0.0	0.0	94.1	5.9	17	5.9	−12.1	23.9	0.8	1.6	92.0	5.6	251	4.8	0.1	9.5	0.24
Headache	0.9	1.7	84.6	12.8	117	11.9	2.4	21.5	0.0	0.0	75.0	25.0	16	25.0	−0.8	50.8	0.0	1.1	82.7	16.2	266	16.2	9.8	22.5	0.33
100% on stroke symptoms	1.0	1.9	80.0	17.1	105	**16.1**	5.6	26.7	0.0	0.0	75.0	25.0	16	**25.0**	−2.0	52.0	0.4	3.0	80.4	16.1	230	**15.7**	9.5	22.8	0.64

Percentages are reported for each combination of pre-/post-knowledge and awareness responses: R/W indicates a right answer on the pretest and a wrong answer on the post-test, corresponding to a loss of knowledge. Similarly, two combinations correspond to no change in knowledge: W/W (for wrong/wrong) and R/R (for right/right). A gain in knowledge corresponds to the combination W/R (for wrong/right). Mean change reports the difference in the percentage gaining knowledge versus the percentage losing knowledge and is reported along with the lower bound (LB) and upper bound (UB) of a 95% confidence interval (CI). The *p*-value is from the omnibus *F*-test of a one-way analysis of variance (ANOVA) comparing groups on mean within-person change scores, which were scored 1 for a gain in knowledge, −1 for a loss in knowledge, and 0 for no change.

Bold values = 100% correct replies.

HD, heart disease.

African American and 4.9% for Caucasian/Other racial group women, $p < 0.05$). The awareness gains for American Indian women were primarily due to the awareness of heart disease as the leading killer of women. American Indian women also achieved the greatest knowledge gains in taking appropriate action for symptoms (defined by correctly answering 100% of the questions) compared with other racial group women. Overall, there was an 80% gain in knowledge for taking emergency action for American Indian women (compared with 63.9% gain for African American and 46.3% gain for Other racial group women, $p < 0.05$). The knowledge increase in taking action was driven primarily by an 86.7% increase in knowledge to not ''ask a friend or relative to drive you to the nearest hospital.'' Pretest, American Indian women were the least able to correctly identify family history as a risk factor (79.0%) for heart disease, compared with African American women (90.8%) and Caucasian/Other racial group women (92.2%). Postintervention, American Indian women achieved significantly higher gains in knowledge of heart disease risk factors (overall 46.7%%, compared with the other racial groups [$p = 0.05$]). Although all racial groups attained knowledge gains for heart disease or stroke symptoms, the differences between racial groups were not statistically significant.

Ethnic minority women demonstrated low knowledge and awareness of heart disease, which was improved by the educational intervention

The pre–post change score analysis for ethnicity (Table 5) showed that Hispanic women demonstrated greater gains for overall awareness of heart disease risk factors compared with non-Hispanic women. The awareness gains for Hispanic women (defined by correctly answering 100% of the awareness questions) were 17.8% (compared with a 4.7% gain for non-Hispanic women, $p < 0.01$). The knowledge gains for Hispanics in awareness were primarily due to improved awareness of heart disease as the leading killer of women, whereas the knowledge gains for heart disease risk factors were due to awareness of menopause (45.4% gain for Hispanic vs. 27.5% for non-Hispanic women, $p < 0.05$) and family history of heart disease (14.9% gain for Hispanic vs. 5.1% for non-Hispanic women, $p < 0.05$) as risk factors. There were no significant overall differences in knowledge gains between Hispanic and non-Hispanic women for taking action for heart disease symptoms or symptoms of heart disease.

Nonurban women demonstrated low knowledge and awareness of heart disease, which was improved by the educational intervention

The pre–post change score analysis for urban/nonurban status (Table 6) revealed that nonurban women had greater gains in awareness (by correctly answering 100% of the awareness questions) compared with urban women (15.3% compared with 3.6% gain, respectively, $p < 0.01$). This difference was driven primarily by awareness of heart disease as the leading killer of women ($p < 0.01$). Although the difference between urban and nonurban women for correctly answering 100% of the heart disease risk factors domain questions was not significantly different after the intervention, nonurban women demonstrated a significantly greater gain in their ability to recognize family history as a risk factor for heart disease (13.4% compared with 4.2% for urban women, $p < 0.01$). Postintervention, women in nonurban communities continued to answer a lower percentage of the questions correctly in several categories, but most differences were not statistically significant from preintervention. The greatest postdifferences were for correctly answering 100% of the taking action knowledge domain questions (63.9% nonurban compared with 89.0% urban women, $p < 0.01$). Also, compared with urban women, significantly fewer nonurban women correctly answered 100% of the heart disease symptom questions (87.5% nonurban versus 94.5% urban women, $p < 0.05$) or stroke symptom questions (92.2% nonurban versus 98.2 urban women, $p < 0.01$).

Discussion

This study assessed racial and ethnic minority women and those in nonurban settings, for their knowledge of heart disease as the leading killer of women, the major risk factors, the symptoms of heart attack and stroke, and of taking appropriate action for symptoms. Assessment of group-specific within-learner changes demonstrates that although knowledge and awareness of heart disease have improved over the past 15 years, many women remain unaware that heart disease is the leading killer of women, of the major risk factors for heart disease, the symptoms of heart disease and stroke, and of taking appropriate action for symptoms by calling 911.[3] In addition, there are important disparities in knowledge and awareness across race, ethnicity, and urban status, particularly for women of American Indian race, Hispanic ethnicity, and nonurban status.[22,23] We demonstrated the specific knowledge gaps present for racial/ethnic minority women and those in nonurban settings. In addition, although firm conclusions cannot be drawn about the effect of the intervention studied without a control group, the study has provided evidence of feasibility in delivering an educational intervention in a clinic setting.

Previous studies have highlighted some cardiovascular disease knowledge gaps across race and ethnicity, particularly as pertaining to awareness of heart disease as the leading killer of women and of taking appropriate action for symptoms.[3,22,24] However, to our knowledge, this study is the first to comprehensively assess specific knowledge gaps across many knowledge and awareness domains and across race, ethnicity, and urban status. Our study also included a sample of American Indian women, a relatively understudied group, who have been shown to be in need of heart disease education for symptoms[25] and culturally appropriate health prevention, especially for smoking.[26] According to the Strong Heart Study, the largest and longest epidemiological study on heart disease and its risk factors in American Indians, the incidence of heart disease among American Indians is double the rate in the general U.S. population, and it has increased over the past 50 years (http://www.nhlbi.nih.gov/news/spotlight/fact-sheet/strong-heart-study-targets-high-rate-heart-disease-among-American-Indians).[27] Recent data from the AHA National Survey indicated that African American and Hispanic women were also significantly less likely than Caucasian women to be aware of heart disease as a leading health threat.[3,28,29] Our study is consistent with racial/ethnic minority status, as well as nonurban status, being associated with lower heart disease knowledge and awareness in women.

Table 5. Knowledge Change Score Analysis for Women by Ethnicity

	Hispanic (n=54)								*Non-Hispanic* (n=418)								
	Loss (−1)	*No change (0)*		*Gain (+1)*			*95% CI*		*Loss (−1)*	*No Change (0)*		*Gain (+1)*			*95% CI*		
Knowledge domain	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean Gain×100*	*LB*	*UB*	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean Gain×100*	*LB*	*UB*	p
Awareness																	
Leading killer	0.0	0.0	87.2	12.8	47	12.8	5.4	20.1	0.0	0.0	96.5	3.5	397	3.5	1.0	6.1	**0.004**
Heart disease preventable	0.0	2.2	93.5	4.4	46	4.4	−4.0	12.7	2.3	0.9	93.8	3.1	353	0.8	−2.2	3.8	0.33
100% on awareness questions	0.0	2.2	80.0	17.8	45	**17.8**	6.6	28.9	2.0	0.9	90.4	6.7	344	**4.7**	0.6	8.7	**0.007**
Taking Action																	
Call 911	2.2	0.0	91.1	6.7	45	4.5	−2.7	11.6	0.6	0.3	96.5	2.7	366	2.1	−0.3	4.7	0.47
Call doctor that day	2.6	12.8	66.7	18.0	39	15.4	3.7	27.0	1.7	0.4	92.3	5.5	235	3.8	−0.9	8.6	**0.03**
Drive self to hospital	7.0	2.3	70.0	20.9	43	13.9	0.4	27.5	0.4	0.4	87.7	11.5	244	11.1	5.4	16.8	0.63
Have friend drive to hospital	4.6	38.6	9.1	47.7	44	43.1	23.0	63.3	1.9	11.2	30.0	56.9	260	55.0	46.7	63.3	0.18
Ignore symptoms	7.1	0.0	92.9	0.0	42	−7.1	−13.9	−0.4	1.7	0.0	97.5	0.8	237	−0.9	−3.7	2.0	**0.04**
100% on take action	2.6	44.7	10.5	42.1	38	**39.5**	18.7	60.3	0.9	12.1	30.8	56.3	224	**55.4**	46.8	63.9	0.08
Heart Disease Risk Factors																	
High blood pressure	0.0	0.0	97.9	2.1	47	2.1	−4.1	8.4	1.0	1.2	95.6	2.2	410	1.2	−0.9	3.3	0.74
No exercise	0.0	0.0	100.0	0.0	48	0.0	−5.5	5.5	0.3	0.5	96.8	2.5	404	2.2	0.3	4.1	0.35
High cholesterol	0.0	0.0	95.8	4.2	48	4.2	−1.3	9.7	0.7	1.2	96.6	1.5	408	0.8	−1.2	2.6	0.15
Smoking	0.0	0.0	87.2	12.8	47	12.8	3.7	21.9	0.5	1.2	92.7	5.6	408	5.1	2.1	8.2	0.05
Menopause	2.3	2.3	47.7	47.7	44	45.4	28.4	62.5	0.0	3.2	69.3	27.5	345	27.5	21.5	33.6	**0.02**
Diabetes	4.3	4.3	72.3	19.2	47	14.9	2.4	27.4	1.3	1.8	86.4	10.6	396	9.3	5.0	13.6	0.30
Depression	0.0	4.4	63.0	32.6	46	32.6	16.6	48.6	1.4	2.6	74.4	21.7	351	20.3	14.4	26.0	0.07
Obesity	0.0	0.0	93.8	6.3	48	6.3	−0.5	13.0	0.5	0.0	96.6	2.9	410	2.4	0.1	4.8	0.19
Family history	0.0	2.1	83.0	14.9	47	14.9	5.1	24.7	1.0	1.7	91.2	6.1	410	5.1	1.8	8.4	**0.02**
100% on HD risk factors	0.0	11.6	32.6	55.8	43	**55.8**	37.0	74.6	1.7	7.0	57.8	33.6	301	**31.9**	24.8	39.0	**0.004**
Heart Disease Symptoms																	
Chest pain	0.0	0.0	89.4	10.6	47	10.6	2.4	18.9	0.0	0.8	94.2	5.0	381	5.0	2.1	7.9	0.11
Shortness of breath	0.0	0.0	87.2	12.8	47	12.8	3.8	21.7	0.5	1.3	92.8	5.3	375	4.8	1.6	8.0	**0.04**
Sweatiness	0.0	0.0	85.1	14.9	47	14.9	5.2	24.6	0.0	1.7	91.2	7.1	364	7.1	3.7	10.6	0.07
Fatigue	0.0	0.0	97.7	2.3	43	2.3	−10.3	15.0	1.4	1.4	85.0	12.2	360	10.8	6.5	15.2	0.12
Pain spreading to jaw	4.6	2.3	75.0	18.2	44	13.6	1.2	26.0	0.6	1.7	87.4	10.4	364	9.8	5.6	14.2	0.48
Nausea	2.3	2.3	72.7	22.7	44	20.4	7.6	33.3	0.3	2.0	85.7	12.0	350	11.7	7.1	16.3	0.12
Fainting	2.1	2.1	80.9	14.9	47	12.8	1.2	24.3	0.3	1.4	87.8	10.5	353	10.2	6.0	14.4	0.61
Feeling of doom	0.0	0.0	56.1	43.9	41	43.9	25.1	62.7	0.9	2.5	63.6	33.0	324	32.1	25.4	38.8	0.15
100% on HD symptoms	5.3	7.9	36.8	50.0	38	**44.7**	23.2	66.2	2.1	4.2	52.3	41.5	289	**39.4**	31.6	47.2	0.57
Stroke Symptoms																	
Sudden weakness	0.0	0.0	91.5	8.5	47	8.5	0.9	16.1	0.0	1.1	94.7	4.2	377	4.2	1.6	6.9	0.19
Sudden dimness	0.0	2.1	89.4	8.5	44	8.5	−2.0	19.0	0.6	1.4	89.3	8.8	335	8.2	4.5	12.1	0.96
Loss of speech	2.1	0.0	89.4	8.5	47	6.4	−2.7	15.4	0.0	1.4	92.4	6.2	370	6.2	3.0	9.4	0.97
Dizziness	0.0	2.3	88.6	9.1	44	9.1	−0.7	18.9	0.6	1.5	91.3	6.6	335	6.0	2.4	9.5	0.46
Headache	0.0	0.0	81.0	19.1	42	19.1	5.1	33.0	0.3	1.4	83.2	15.1	357	14.8	10.1	19.6	0.48
100% on stroke symptoms	0.0	4.9	73.2	22.0	41	**22.0**	7.2	36.7	0.7	2.3	81.0	16.1	310	**15.4**	10.1	20.9	0.31

Percentages are reported for each combination of pre-/post-knowledge and awareness responses: R/W indicates a right answer on the pretest and a wrong answer on the post-test, corresponding to a loss of knowledge. Similarly, two combinations correspond to no change in knowledge: W/W (for wrong/wrong) and R/R (for right/right). A gain in knowledge corresponds to the combination W/R (for wrong/right). Mean change reports the difference in the percentage gaining knowledge versus the percentage losing knowledge and is reported along with the LB and UB of a 95% CI. The *p*-value is from the omnibus F-test of a one-way ANOVA comparing groups on mean within-person change scores, which were scored 1 for a gain in knowledge, −1 for a loss in knowledge, and 0 for no change.

Bold values = 100% correct replies.

Table 6. Knowledge Change Score Analysis for Women by Urban/Nonurban Status

	Nonurban (n = *100*)								*Urban* (n = *372*)								
	Loss (−1)	*No change (0)*		*Gain (+1)*			*95% CI*		*Loss (−1)*	*No change (0)*		*Gain (+1)*			*95% CI*		
Knowledge domain	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean change × 100*	*LB*	*UB*	*R/W*	*W/W*	*R/R*	*W/R*	n	*Mean change × 100*	*LB*	*UB*	p
Awareness																	
Leading killer	0.0	0.0	89.3	10.8	93	10.8	5.5	15.9	0.0	0.0	97.2	2.9	351	2.9	0.2	5.5	**0.001**
Heart disease preventable	1.1	0.0	95.5	3.4	88	2.3	−3.7	8.3	2.3	1.3	93.3	3.2	311	1.0	−2.2	4.2	0.64
100% on awareness questions	0.0	0.0	84.7	15.3	85	**15.3**	7.2	23.4	2.3	1.3	90.5	5.9	304	**3.6**	−0.7	7.9	**0.002**
Taking Action																	
Call 911	1.1	0.0	96.6	2.3	88	1.2	−4.0	6.3	0.6	0.3	95.7	3.4	323	3.2	0.1	5.5	0.48
Call doctor that day	2.7	4.1	80.8	12.3	73	9.6	1.0	18.1	1.5	1.5	91.5	5.5	201	7.3	−1.2	9.1	0.17
Drive self to hospital	4.0	0.0	86.7	9.3	75	5.3	−4.9	15.5	0.5	0.9	84.4	14.2	212	13.7	7.6	19.8	0.09
Have friend drive to hospital	2.6	32.5	15.6	49.4	77	46.8	31.5	62.0	2.2	9.3	30.8	57.7	227	55.6	46.6	64.4	0.22
Ignore symptoms	2.7	0.0	96.0	1.4	73	−1.3	−6.5	3.8	2.4	0.0	97.1	0.5	206	0.7	−5.0	1.1	0.82
100% on take action	1.4	34.7	16.7	47.2	72	**45.8**	30.7	61.0	1.1	10.0	32.1	56.8	190	**55.8**	46.5	65.1	0.17
Heart Disease Risk Factors																	
High blood pressure	0.0	2.1	95.8	2.1	95	2.1	−2.3	6.5	1.1	0.8	95.9	2.2	362	1.1	−1.2	3.4	0.62
No exercise	0.0	1.1	96.8	2.1	95	2.1	−1.8	6.0	0.3	0.3	97.2	2.2	357	1.9	−0.1	4.0	0.94
High cholesterol	0.0	2.1	95.7	2.1	94	2.1	−1.8	6.1	0.8	0.8	96.7	1.7	362	0.9	0.8	2.8	0.47
Smoking	0.0	2.1	89.6	8.3	96	8.3	2.0	14.7	0.6	0.8	92.8	5.9	359	5.3	2.0	8.6	0.30
Menopause	1.2	2.3	61.6	34.9	86	33.7	21.5	46.0	0.0	3.3	68.3	28.4	303	28.4	21.9	34.9	0.35
Diabetes	2.1	4.2	80.2	13.5	96	11.4	2.7	20.2	1.4	1.4	86.2	11.0	347	9.6	4.9	14.1	0.63
Depression	1.1	4.6	71.6	22.7	88	21.6	15.5	27.9	1.3	2.3	73.5	23.0	309	21.7	10.0	33.2	0.99
Obesity	0.0	0.0	94.9	5.2	97	5.2	0.4	9.9	0.6	0.0	96.7	2.8	361	2.2	−0.2	4.7	0.18
Family history	0.0	3.1	83.5	13.4	97	13.4	6.6	20.2	1.1	1.4	92.2	5.3	360	4.2	0.6	7.7	**0.003**
100% on HD risk factors	0.0	12.7	46.8	40.5	79	**40.5**	26.5	54.5	1.9	6.0	57.0	35.1	265	**33.2**	25.6	40.9	0.03
Heart Disease Symptoms																	
Chest pain	0.0	2.3	89.8	8.0	88	8.0	1.9	14.0	0.0	0.3	94.7	5.0	340	5.0	1.9	8.1	0.28
Shortness of breath	1.2	2.3	88.5	8.1	87	6.9	0.3	13.5	0.3	0.9	93.1	5.7	335	5.4	2.0	8.8	0.62
Sweatiness	0.0	2.4	84.7	12.9	85	12.9	5.7	20.2	0.0	1.2	92.0	6.8	326	6.8	3.1	10.4	0.06
Fatigue	0.0	3.6	85.7	10.7	84	10.7	1.6	19.8	1.6	0.6	86.5	11.3	319	9.7	5.1	14.4	0.81
Pain spreading to jaw	2.4	3.6	84.5	9.5	84	7.1	−1.8	16.1	0.6	1.2	86.4	11.7	324	11.1	6.5	15.7	0.33
Nausea	0.0	4.9	76.5	18.5	81	18.5	9.0	28.0	0.6	1.3	86.3	11.8	313	11.2	6.4	16.0	0.09
Fainting	0.0	3.7	81.7	14.6	82	14.6	5.9	23.3	0.6	0.9	88.4	10.1	318	9.5	5.0	13.9	0.19
Feeling of doom	0.0	5.3	52.6	42.1	76	42.1	28.3	55.9	1.0	1.4	65.4	32.2	289	31.2	24.1	38.2	0.08
100% on HD symptoms	1.4	11.1	38.9	48.6	72	**47.2**	31.6	62.8	2.8	2.8	53.7	40.8	255	**38.0**	29.8	46.3	0.20
Stroke Symptoms																	
Sudden weakness	0.0	2.3	92.1	5.7	88	5.7	0.1	11.2	0.0	0.6	94.9	4.5	336	4.5	1.6	7.3	0.63
Sudden dimness	0.0	3.5	83.7	12.8	86	12.8	5.0	20.5	0.6	0.9	90.7	7.7	324	7.1	3.1	11.1	0.11
Loss of speech	0.0	2.3	89.8	8.0	88	8.0	1.4	14.6	0.3	0.9	92.7	6.1	329	5.8	2.4	9.2	0.47
Dizziness	2.4	2.4	85.7	9.5	84	7.1	0.0	14.2	0.0	1.4	92.5	6.1	295	6.1	2.3	9.9	0.75
Headache	0.0	3.7	75.6	20.7	31.7	20.7	10.8	30.7	0.3	0.6	84.9	14.2	82	13.9	8.8	18.9	0.13
100% on stroke symptoms	1.3	6.5	68.8	23.4	77	**22.1**	11.3	32.8	0.4	1.5	83.2	15.0	274	**14.6**	8.9	20.3	0.13

Percentages are reported for each combination of pre-/post-knowledge and awareness responses: R/W indicates a right answer on the pretest and a wrong answer on the post-test, corresponding to a loss of knowledge. Similarly, two combinations correspond to no change in knowledge: W/W (for wrong/wrong) and R/R (for right/right). A gain in knowledge corresponds to the combination W/R (for wrong/right). Mean change reports the difference in the percentage gaining knowledge versus the percentage losing knowledge and is reported along with the LB and UB of a 95% CI. The *p*-value is from the omnibus F-test of a one-way ANOVA comparing groups on mean within-person change scores, which were scored 1 for a gain in knowledge, −1 for a loss in knowledge, and 0 for no change.
Bold values = 100% correct replies.

Our study provides insight into opportunities to specifically target future educational efforts and content to women in clinical settings by racial/ethnic and nonurban/urban status. However, prior studies demonstrate that only about half of racial minority women have received prior counseling on heart-healthy eating and risk factor counseling in the clinic setting,[30] despite the Center for Disease Control report that 49% of Americans have at least one of three major heart disease risk factors.[31] Our results suggest that ethnic and nonurban minority women in particular require specifically tailored education about the risk factors for heart disease, the importance of knowing their own individual values for risk factors, and risk behavior counseling. Overall, nonurban women in our study had the least heart disease knowledge and awareness across all domains. This is particularly of concern given the fact that the Center for Rural Health has reported that nationally, rural residents fare worse than their urban counterparts in both heart disease deaths and associated risk factors.[16] In addition, a lack of awareness of heart disease risk factors translates into an underestimation of risk in both urban and racial minority women.[32]

Unlike previous studies assessing differences in knowledge and awareness of heart disease in subgroups of women,[28,33,34] we also developed and assessed a pre-/post-educational intervention. Our intervention differed from others in that it was designed to be delivered in the clinic setting by busy healthcare professionals and within the context of a clinical visit. The intervention was effective in improving awareness and knowledge in all of the educational domains addressed, irrespective of race, ethnicity, and urban status. Thus, the clinic setting may provide a critical opportunity for learning that can favorably impact a broad range of women at the time they seek care. However, only a small portion of our study subjects reported receipt of counseling in a previous healthcare setting, thus indicating the opportunity for increased efforts in this regard.

For those groups that did not demonstrate significant improvement in awareness and knowledge, specifically for taking appropriate action, a number of barriers may have been at play. Although we did not assess immigration status, undocumented Hispanic individuals may hesitate or decline to call 911 for fear of legal repercussions.[35] Additionally, distrust of the medical establishment has been shown to be a major barrier for underrepresented racial and ethnic minorities in previous studies.[36,37] Cultural factors, access to healthcare, personal health beliefs, and socio-demographic issues may also contribute to the lack of heart disease knowledge and awareness, and education, in racial/ethnic and urban status minorities.[3,38–41] However, our previous work demonstrated the efficacy of a culturally appropriate program to overcome some of these barriers in community settings in high-risk women.[42] This underscores the importance of culturally appropriate interventions, interventions designed to foster trust, and bilingual programs (where applicable) in combating disparities in heart disease knowledge and awareness. Although our intervention was bilingual and delivered in Spanish and English, no other measures were made for cultural appropriateness and this may have mitigated additional knowledge gains.

Our study has a number of limitations. One limitation of the study is the use of a pre-/post-design for measuring knowledge that spanned approximately an hour between assessments, such that retention of longer-term information was not assessed. We also recognize that knowledge does not necessarily always translate to behavior change, and an additional limitation of this study is the lack of long-term follow-up to assess health outcomes from the educational intervention, and to assess retention of the information provided by a single clinic educational encounter. It is well known that heart-healthy lifestyles are the cornerstone of heart disease prevention,[8,43] and that self-regulation of individual health behavior is an important interrelationship between knowledge and health. However, we have previously published that similar educational programs sustained over a period of 4–6 months do, in fact, result in sustained improvements in heart disease risk profiles, a reduction in inflammatory burden, and cardiometabolic risk in racial/ethnic minority women.[6,20,42] In addition, others have demonstrated that awareness translates to action and poor health behaviors translate to physical health disorders,[44] pointing to the importance of awareness and knowledge as an important factor in the path to improved physical health. It is unclear as to what extent baseline knowledge predicted change in knowledge in our study, and whether the gains observed were, in part, attributable to lower baseline knowledge. Baseline knowledge may have been, to some extent, predictive of change in knowledge, particularly for American Indian women who tended to have the lowest baseline knowledge levels. We also acknowledge that the small number of American Indian women in this study has implications for representativeness, and that our findings may not be generalizable to that population as a whole. However, other comparable studies that examine knowledge about heart disease among American Indian women are limited. Similarly, unmeasured factors in our study (past medical history, history of heart disease, baseline health status, and differences in educational level) may have affected knowledge outcomes, contributed to observed racial/ethnic differences in knowledge, and impacted observed differences in knowledge at urban versus nonurban study centers. Furthermore, overlap among the categories (*e.g.,* ethnicity and rural status) was not specifically addressed in the analysis and could impact the inferences made based on the results.

Conclusion

Our results support the findings of others that demonstrate a need for increased efforts to deliver education on heart disease prevention in the clinical setting.[43,45] Specifically, our work suggests that education is needed related to awareness of heart disease as the leading killer of women, its risk factors, and taking appropriate emergency action for symptoms. In addition, more attention could be given to including nonurban status as a possible indicator for lower heart disease knowledge. Lastly, awareness of specific heart disease knowledge gaps in racial and ethnic minority women in urban and rural communities could help inform future research on how to help health professionals optimize the education they offer to subsets of women.

Acknowledgments

This publication was made possible by Grant Number UL1 RR024146 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health

(NIH), and NIH Roadmap for Medical Research. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of NCRR or NIH. This publication was also made possible by the Frances Lazda Endowment in Women's Cardiovascular Medicine to A.C.V.

Author Disclosure Statement

No competing financial interests exist.

References

1. System NVS. Leading causes of death by age group, all females United States, 2013. Mortality Tables 2013;64:1–119.
2. Mosca L, Linfante AH, Benjamin EJ, et al. National study of physician awareness and adherence to cardiovascular disease prevention guidelines. Circulation 2005;111:499–510.
3. Mosca L, Hammond G, Mochari-Greenberger H, Towfighi A, Albert MA. Fifteen-year trends in awareness of heart disease in women: Results of a 2012 American Heart Association National Survey. Circulation 2013;127:1254–1263, e1–e29.
4. Kling JM, Miller VM, Mankad R, et al. Go red for women cardiovascular health–screening evaluation: The dichotomy between awareness and perception of cardiovascular risk in the community. J Womens Health 2013;22:210–218.
5. Bello N, Mosca L. Epidemiology of coronary heart disease in women. Prog Cardiovasc Dis 2004;46:287–295.
6. Villablanca AC, Beckett LA, Li Y, et al. Outcomes of comprehensive heart care programs in high-risk women. J Womens Health (Larchmt) 2010;19:1313–1325.
7. Mosca L, Benjamin EJ, Berra K, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women—2011 update. J Am Coll Cardiol 2011;57:1404–1423.
8. Go AS, Mozaffarian D, Roger VL, et al. Heart disease and stroke statistics—2014 update: A report from the American Heart Association. Circulation 2014;129:e28–e292.
9. Jouyandeh Z, Nayebzadeh F, Qorbani M, Asadi M. Metabolic syndrome and menopause. J Diabetes Metab Disord 2013;12:1.
10. Crea F, Battipaglia I, Andreotti F. Sex differences in mechanisms, presentation and management of ischemic heart disease. Atherosclerosis 2015;241:157–168.
11. Patel H, Rosengren A, Ekman I. Symptoms in acute coronary syndromes: Does sex make a difference? Am Heart J 2004;148:27–33.
12. Aronow WS, Ahn C, Mercando AD. Prevalence of and association between silent myocardial ischemia and new coronary events in older men and women with and without cardiovascular disease. J Am Geriatr Soc 2002;50:1075–1078.
13. Bushy A. Health issues of women in rural environments: An overview. J Am Med Womens Assoc 1998;53:53–56.
14. Clifford WB, Lilley SC. Rural elderly: Their demographic characteristics. In: Bull CN, ed. Aging in rural America. Newbury Park, CA/London, England: Sage Publications, 1993:3–16.
15. Hammer J, Wilder B. Knowledge and risk of cardiovascular disease in rural Alabama women. J Am Acad Nurse Pract 2008;20:333–338.
16. Knudson A, Michael M, Popat S. Rural-urban disparities in heart disease. Policy Brief #1 from the 2014 Update of the Rural-Urban Chartbook. 2014. www.ruralhealth.und.edu/projects/health-reform-policy-research-center/pdf/2014-rural-urban-chartbook-update.pdf Accessed June 20, 2016.
17. Veazie M, Ayala C, Schieb L, Dai S, Henderson JA, Cho P. Trends and disparities in heart disease mortality among American Indians/Alaska natives, 1990–2009. Am J Public Health 2014;104:S359–S367.
18. Murphy SL, Xu J, Kochanek KD. Deaths: Final data for 2010. Natl Vital Stat Rep 2013;61:1–117.
19. Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for U.S. Adults: National health interview survey, 2012. Vital Health Stat 2014:1–161.
20. Villablanca AC, Arline S, Lewis J, Raju S, Sanders S, Carrow S. Outcomes of national community organization cardiovascular prevention programs for high-risk women. J Cardiovasc Transl Res 2009;2:306–320.
21. Agresti A, Min Y. Effects and non-effects of paired identical observations in comparing proportions with binary matched-pairs data. Stat Med 2004;23:65–75.
22. Mosca L, Mochari-Greenberger H, Dolor RJ, Newby LK, Robb KJ. Twelve-year follow-up of American women's awareness of cardiovascular disease risk and barriers to heart health. Circ Cardiovasc Qual Outcomes 2010;3:120–127.
23. Mochari-Greenberger H, Mills T, Simpson SL, Mosca L. Knowledge, preventive action, and barriers to cardiovascular disease prevention by race and ethnicity in women: An American heart association national survey. J Womens Health 2010;19:1243–1249.
24. Christian AH, Rosamond W, White AR, Mosca L. Nine-year trends and racial and ethnic disparities in women's awareness of heart disease and stroke: An american heart association national study. J Womens Health (Larchmt) 2007;16:68–81.
25. Struthers R, Savik K, Hodge FS. American Indian and cardiovascular disease: Response behaviors to chest pain. J Cardiovasc Nurs 2004;19:158–163.
26. Schweigman K, Eichner J, Welty T, Zhang Y. Cardiovascular disease risk factor awareness in American Indian communities: The strong heart study. Ethn Dis 2006;16:647–652.
27. Strong Heart Study. http://www.nhlbi.nih.gov/news/spotlight/fact-sheet/strong-heart-study-targets-high-rate-heart-disease among-American-Indians Accessed April 20, 2016.
28. Mochari-Greenberger H, Miller KL, Mosca L. Racial/ethnic and age differences in women's awareness of heart disease. J Womens Health (Larchmt) 2012;21:476–480.
29. Mosca L, Ferris A, Fabunmi R, Robertson RM. Tracking women's awareness of heart disease: An American Heart Association national study. Circulation 2004;109:573–579.
30. Whitlock EP, Williams SB. The primary prevention of heart disease in women through health behavior change promotion in primary care. Womens Health Issues 2003;13:122–141.
31. Bureau NVSSatUSC. Women and heart disease fact sheet. 2013. www.cdc.gov/dhdsp/data_statistics/fact_sheets/docs/fs_women_heart.pdf Accessed June 20, 2016.
32. DeSalvo KB, Gregg J, Kleinpeter M, Pedersen BR, Stepter A, Peabody J. Cardiac risk underestimation in urban, black women. J Gen Intern 2005;20:1127–1131.
33. Fang J, Gillespie C, Keenan NL, Greenlund KJ. Awareness of heart attack symptoms among US adults in 2007, and changes in awareness from 2001 to 2007. Future Cardiol 2011;7:311–320.

34. Giardina EG, Sciacca RR, Flink LE, Bier ML, Paul TK, Moise N. Cardiovascular disease knowledge and weight perception among Hispanic and non-Hispanic white women. J Womens Health (Larchmt) 2013;22:1009–1015.
35. Sasson C, Haukoos JS, Ben-Youssef L, et al. Barriers to calling 911 and learning and performing cardiopulmonary resuscitation for residents of primarily Latino, high-risk neighborhoods in Denver, Colorado Ann Emerg Med 2015; 65:545–552.
36. Chin AL, Negash S, Hamilton R. Diversity and disparity in dementia: The impact of ethnoracial differences in Alzheimer disease. Alzheimer Dis Assoc Disord 2011;25:187–195.
37. Clark PA. Prejudice and the medical profession: A five-year update. J Law Med Ethics 2009;37:118–133.
38. Kandula NR, Khurana NR, Makoul G, Glass S, Baker DW. A community and culture-centered approach to developing effective cardiovascular health messages. J Gen Intern Med 2012;27:1308–1316.
39. Blanchard JC, Haywood YC, Scott C. Racial and ethnic disparities in health: An emergency medicine perspective. Acad Emerg Med 2003;10:1289–1293.
40. Gellad WF, Haas JS, Safran DG. Race/ethnicity and non-adherence to prescription medications among seniors: Results of a national study. J Gen Intern Med 2007;22: 1572–1578.
41. Lutfiyya MN, Cumba MT, McCullough JE, Barlow EL, Lipsky MS. Disparities in adult African American women's knowledge of heart attack and stroke symptomatology: An analysis of 2003–2005 behavioral risk factor surveillance survey data. J Womens Health (Larchmt) 2008;17:805–813.
42. Altman R, Nunez de Ybarra J, Villablanca AC. Community-based cardiovascular disease prevention to reduce cardiometabolic risk in Latina women: A pilot program. J Womens Health (Larchmt) 2014;23:350–357.
43. Pearson TA, Palaniappan LP, Artinian NT, et al. American heart association guide for improving cardiovascular health at the community level, 2013 update: A scientific statement for public health practitioners, healthcare providers, and health policy makers. Circulation 2013;127:1730–1753.
44. Jackson JL, Tierney K, Daniels CJ, Vannatta K. Disease knowledge, perceived risk, and health behavior engagement among adolescents and adults with congenital heart disease. Heart Lung 2015;44:39–44.
45. DeVol R, Bedroussian A. An unhealthy America: The economic burden of chronic disease. 2007;2015. www.assets1c.milkeninstitute.org/assets/Publication/ResearchReport/PDF/chronic_disease_report.pdf Accessed June 20, 2016.

Address correspondence to:
Amparo C. Villablanca, MD
Division of Cardiovascular Medicine
University of California, Davis
One Shields Avenue, TB 172
Davis, CA 95616-8636

E-mail: avillablanca@ucdavis.edu